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Cover

Since the early 1900's, research has been underway in the Southwest to find ways of improving forage productivity on grass and shrub rangelands. This 1916 photo shows specialists conducting fenced plot studies. Today, scientists have found that prescribed burning can help increase good forage species. Details begin on page 1.

To Order Publications

Single copies of publications referred to in this magazine are available without charge from the issuing station unless another source is indicated. See page 15 for ordering cards.

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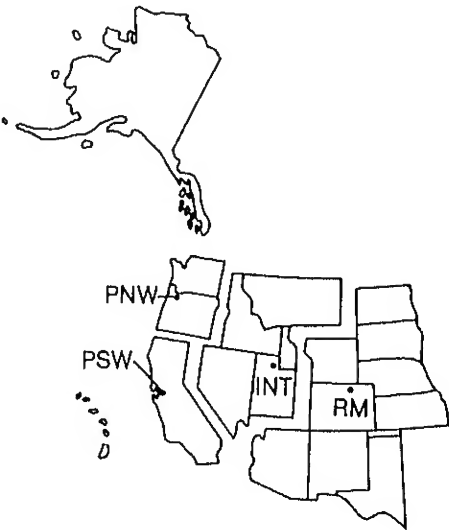
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Burning improves southwestern ranges

by Rick Fletcher
Rocky Mountain Station



Southwestern grass-shrub ranges have supported a viable livestock industry for well over 100 years. From the "boom and bust" days of the open range, livestock production has progressed. The primary concern is no longer to raise as many cattle as fast as possible, regardless of the environmental consequences. Managers now seek to maintain a productive stand of forage to insure continued high beef production, with little damage to other resources.

While perennial grasses provide the most important forage on grass-shrub ranges, poor grazing management has generally reduced the abundance and production of these preferred grasses. In many places, grass has been replaced, in some degree, by less desirable plants such as mesquite, creosote bush, pricklypear and cholla cacti, burroweed, snakeweed, and various acacias. Invasion by these species not only reduces herbage production, but increases soil erosion.

This has provided a stiff challenge for several Rocky Mountain Station scientists at the Forestry Sciences Lab at Tempe, Arizona. Their efforts are focusing on increasing good forage species, while reducing competing non-forage species.

Most of their studies are being conducted at the Santa Rita Experimental Range, south of Tucson. Established in 1903 to help improve productivity of semidesert rangelands, it is the oldest experimental range in the nation.

Early small-plot studies at Santa Rita showed that control of undesirable plants, such as mesquite, increased grass production. The benefits of mesquite control were confirmed in pasture-wide tests, where mesquite were killed with diesel oil.

Before and after a prescribed burn at Santa Rita.

Numerous herbicides have been evaluated in efforts to control mesquite safely and economically. Results have been moderately successful, but there is much public concern about possible effects of herbicides on human health and the environment. Burning, however, is becoming a frequently proposed alternative to chemical or mechanical methods.

In 1975, scientists at Santa Rita began a 4-year study to learn the response of semidesert vegetation to fall burning. Burning is considered by many to be more environmentally acceptable, and is often less expensive than herbicide spraying or mechanical removal. Fall was selected for the burn because 1) the quantity of herbaceous fuel is greatest during this season, 2) perennial grasses are dormant, and 3) fall fits best with the grazing-rest schedule of the Santa Rita Grazing System. (For information on this, see "The Santa Rita Grazing System," in *Proceedings of the First International Rangeland Congress*, 1978, pages 573-575).

Following a summer of near-average rainfall (192 mm) and a rain-free period of 40 days, four 0.8 hectare plots were burned November 12, 1975. The results had varying, and some quite promising, effects on the vegetation.

Response of shrubs

Except for burroweed, changes in shrub densities were generally too small and erratic to be significant. Fire reduced burroweed to about 40 percent of its original density for one year. However, by 1978, densities were at higher levels than before the burn (partly due to above average cool-season precipitation following burning).

Mesquite (up to 1.5 M tall) was top-killed but recovery by sprouting restored populations to pre-burn stature within 3 years. By 1979 mesquite heights on the burned and unburned control plots were 105 and 116 percent of their respective pre-burn levels.

All-in-all, fire was not effective in reducing shrub densities. Its effect on grasses, however, is a different story.

Grasses

Scientists studied 6 grass species and found the long-range effects of fire ranged from little or none to dramatic.

Perhaps the most promising result from this study was the increase in Lehmann lovegrass (*Eragrostis lehmanniana*). There was little change on burn plots from 1975 to 1976, but densities in 1978 and 1979 were about 5 times as great as before the burn. Even though this introduced South African perennial species is not a preferred grass of livestock, it is as nutritious as most native species, has a greater capability to make use of cool-season moisture, and is better able to grow under shrubs than warm season grasses.



This barrel cactus was killed by a prescribed fire.

Santa Rita threeawn (*Aristida glabrata*) increased following burning by about 78 percent. *Tall threeawns* (*A. hamulosa* and *A. ternipes*) was severely reduced by the burn, but was back to about two-thirds of the original density by 1979.

Black grama (*Bouteloua eriopoda*) did not fare well. Due in part to grazing after burning, densities of this species were reduced by half.

Rothrock grama (*Bouteloua rothrockii*) declined dramatically in the years following burning. However, this species behaves somewhat as an annual, and much of the decrease is contributed to rainfall fluctuations instead of burning.



Most mesquite this size (one-inch diameter) are top-killed, but vigorously resprout following a burn

Densities of *plains bristlegrass* (*Setaria macrostachya*) and *Arizona cottontop* (*Trichachne californica*) were not affected by burning. This is especially encouraging because Arizona cottontop is perhaps the most important native grass on the Santa Rita Range.

Populations of other minor grasses, such as tanglehead, bush muhly and fluffgrass, were too sparse and irregularly distributed to evaluate trends. Together they accounted for less than 2 percent of the perennial grass stand.

Cattle, deer, and jackrabbits were attracted to the burned areas almost immediately. The fire removed most of the accumulated low-value herbage and singed spines off cactus—making them palatable and quite attractive to wildlife and livestock alike.

While results from this study show that fire cannot permanently restore or improve semidesert rangelands, they do suggest that, with appropriate grazing management, periodic burning (every 5–6 years) can maintain a grassland aspect.

They also suggest that Lehmann lovegrass can thrive under periodic burning and is likely to become the dominant species under such a regime. However, more information is needed to develop a good burning prescription.

If you would like additional details on this study, write the Rocky Mountain Station and request *Responses of Semidesert Grasses and Shrubs to Fall Burning*, a reprint from the *Journal of Range Management*, Vol. 36, No. 5.

Living snow fences: a renewed look at an old problem

by Adra McPherson
Rocky Mountain Station

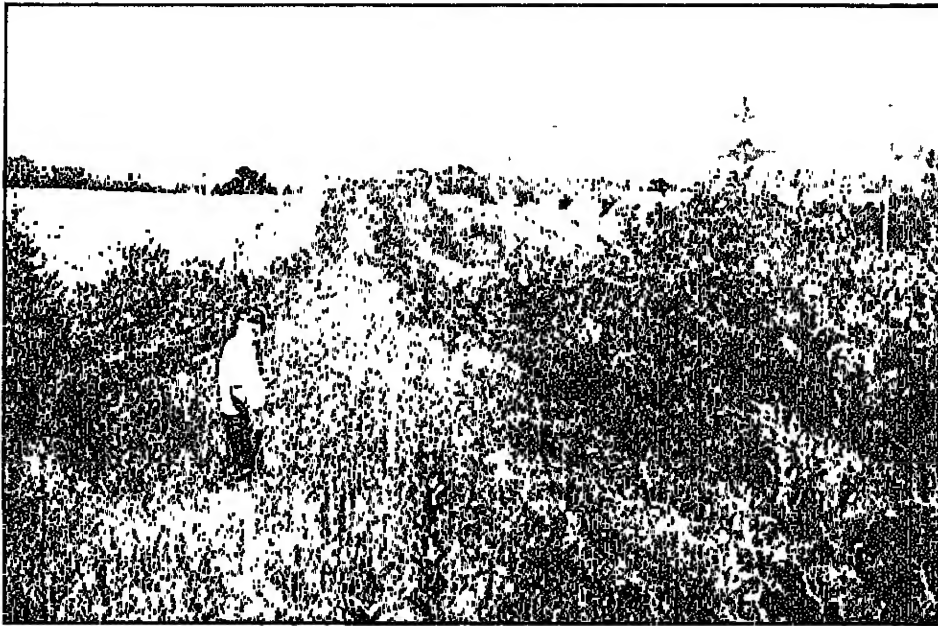
Since the Dust Bowl days of the thirties, travelers across the Plains have become accustomed to the sight of shelterbelts and wooden snow fences designed to tame harsh winter wind and snow, and curb soil erosion.

During that period of devastating drought and wind, the federal govern-

ment launched a Great Plains tree-planting program, titled the Prairie States Forestry Project, to help protect private lands. Assisted by the Civilian Conservation Corps and the Works Progress Administration, the USDA Forest Service planted over 200 million trees in a 200-mile-wide network of shelterbelts from the Dakotas to the Texas panhandle. (The tree-planting program is now administered by the Soil Conservation Service).

Planting came to a virtual standstill during WWII, and resumed with less intensity following the war. In fact, some landowners even began removing their shelterbelts to make way for irrigation systems, or to gain more land for farming. In addition, many of these older shelterbelts were planted too close to the roads and buildings they were supposed to protect, so that snow drifts accumulated where they were least needed. As more attention was given to farming and range management, planting efforts waned, and the "living snow fence" concept was shelved.

But today, resource specialists, government officials, and highway personnel



This Nebraska shelterbelt, planted in 1975, is now very effective in trapping blowing snow, as is shown to the right



are again taking a renewed look at these living fences. In 1975, Nebraska officials established demonstration studies to see just how feasible evergreen plantings could be in controlling drifting and blowing snow. Planting was done along selected stretches of county roads where snow is a common problem. Today, Doak Nickerson, a Nebraska state forester, is eager to explain the many benefits they've experienced so far.

Benefits

Foremost is "do they work"? The answer is a resounding "yes"! During a severe blizzard in December of 1981, for example, highway personnel found that a 7-year-old living snow fence was more efficient than slat fences in providing protection. In an area where both types of fences existed, it was necessary to plow roads behind slat fencing, while the living fences kept the road clear. Anyone who lives in a rural area can appreciate what this might mean in an emergency.

Another major benefit is cost. In Nebraska, experience shows that slatted wooden snow fences cost about \$6,400 per mile to build and maintain. Nearly \$2,000 of this cost is repeated annually in labor and equipment to erect and dismantle slat fences, which have an average life of 5-7 years.

According to Nickerson, cost per mile to install and maintain living fences is about \$2,700. A conservative estimate is that living snow fences last more than 50 years. You can put your own pencil to this and see what the potential savings might add up to.



Mature shelterbelts are desirable habitat for plains deer, where they often raise their young and even live year-round.

Living snow fences also enhance wildlife habitat by providing nesting, roosting, and feeding areas for both songbirds and gamebirds. Wildlife such as deer and rabbits use these plantings for escape cover and places to raise young. In addition, snow fences can be designed for livestock protection, especially during calving time. Finally, most will agree that trees and shrubs are more aesthetically pleasing than rows of wood slat fences.

Spreading interest

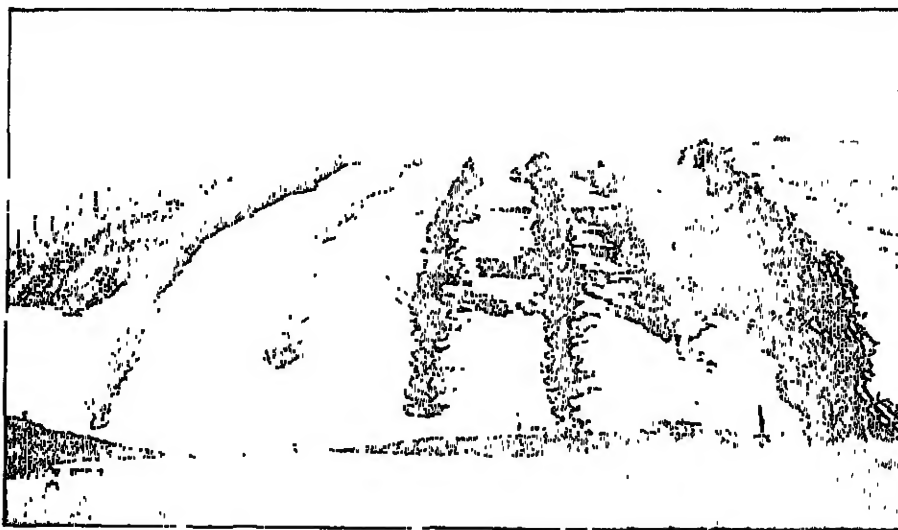
The cooperative approach to establishing snow barriers along prairie highways has spread from Nebraska to Colorado and Wyoming; officials of North Dakota, Montana, South Dakota, and Kansas have also requested information about the living snow fence program.

In October, 1982, a meeting in Denver brought together representatives of Colorado's State and county road departments, landowners, industry, and local, state, and federal natural resource agencies to consider the living snow fence potential in that State.

Officials agreed to work together to establish numerous demonstration plantings in target areas throughout that State in order to learn more about costs, effectiveness, and multipurpose benefits of living snow fence barriers.

The Soil Conservation Service organized local efforts and designed planting plans; landowners provided planting sites at no cost; cash, manpower, and materials were furnished by soil conservation districts, the Division of Wildlife, and State and county road departments, the State Forest Service donated seedlings; a horticultural supply company in Kansas donated drip irrigation supplies, and chemical companies gave rodent repellents. The USDA Forest Service also helped fund the State-wide effort.

By June, 1983, almost four miles of living snow fence had been planted on about 31 acres. A survey in late September, 1983, showed tree and shrub survival to be from 95-100 percent. Eighteen more plantings are scheduled this year, and the program's objective of many miles of living snow fences in Colorado seems assured.



This 5-year-old planting near Cheyenne, Wyoming protects a road and farmstead (out of the picture, to the right). Years ago, county road crews erected the wooden snowfence, right. It, however, wasn't adequate to trap and store the amount of blowing snow the landowner was experiencing. . . the living snowfences are.

In 1983, Wyoming began a 5-year feasibility study of the living snow fence program. This effort, financed from Federal Highway Administration research funds, is administered by the Wyoming Highway Department and Wyoming State Forestry Division. Other agencies donated time, effort, and materials in the spirit of cooperation. The prediction is that living snow fences, where practical, will prove to be more than three times as cost-effective as the wooden type.

Wyoming study sites are located near Cheyenne. Site preparation included plowing, disking, preplant treatment for weed control, installation of drip irrigation systems, and fencing to keep livestock and wildlife out during the establishment period. Some exclosures will be maintained even after the living snow fence has matured to eliminate livestock feeding and rubbing damage on the lower parts of trees.

While young plants are becoming established, 4-foot slat snow fences windward of each shelterbelt will provide some wind protection and cause moisture-laden snow to accumulate in planted areas.

Maintenance of tree-planting sites will include anti-weed spraying for at least three years, rodent control, and drip irrigation to supply water efficiently.

An estimate for the Wyoming program's cost, including nursery stock, planting, irrigation, protective fencing, and maintenance, predicts a savings of \$3,520 per mile per year, or \$88,000 per mile over the life of wooden snow fences in current use.

During the 5-year study in Wyoming, costs of establishing living snow fences and building the conventional variety will be compared. Cost comparisons will also be projected for the useful life expectancies of each.

One enthusiastic supporter for expanding the living snow fence program is Dale Shaw, director of technology transfer for the Colorado State Forest Service. He has been working in both Colorado and Wyoming to implement the living snow fence program, and says "eventually, I believe living snow fences will be accepted throughout the entire Great Plains area. It is becoming such a positive program, with so many positive benefits," he said.

Bringing range knowledge together

by Delpha Noble
Intermountain Station



Western rangelands are vast — and important. Seventeen western states include 70 percent of America's rangelands — more than 700 million acres.

Rangelands always have been a principal source of forage for cattle, sheep, and wildlife. Today more people with diverse needs depend on them. Western rangeland is a vast treasure house of minerals, water, and recreation opportunities while demand for forage production continues to increase.

Range management, an art that has become a science, today faces new challenges to balance demands and production potentials while protecting fragile environments. Meeting these challenges requires knowledge and skill on the part of land managers.

Modern range management is based on a century of research. Current studies are essential to progress, but a rich heritage of information applicable to many current problems exists.

Studies conducted near Oak City, Utah, test different methods of rehabilitating depleted rangelands.

The Intermountain Station has been a center for research activities on western rangelands for over 60 years. The areas of concern have always been broad. The Great Basin Experiment Station and the Desert Experimental Range are field laboratories for Station scientists as they conduct studies on ways to restore and improve the rangelands.

Field laboratories

The Great Basin Station has been the headquarters for research on ecology and management of watersheds and rangelands, as well as on problems of silviculture, since its creation in 1912. The headquarters unit is located in an aspen grove on the west front of the high Wasatch Plateau in Sanpete County in central Utah. Station personnel have investigated and found solutions to special land use problems over a large part of the Great Basin and adjacent upper Colorado River Basin in Utah and Wyoming. The main field laboratory has been in Ephraim Canyon and adjacent drainages on the east side of the Wasatch Plateau.

The Benmore Experimental Range in north-central Utah was set aside for rangeland research because it represented vast areas of land needing rehabilitation and improved management. These lands, originally in native sagebrush-grass vegetation, were important sources of livestock forage in spring and fall. Over a 40-year period, the Forest Service, Utah State University, the Soil Conservation Service, and others conducted studies on vegetation and livestock at Benmore.

The Desert Experimental Range in southwestern Utah is typical of winter grazing lands in the Great Basin. This low-shrub desert has been used as winter range since the late 19th century, soon after domestic livestock arrived in the Intermountain West. President Herbert Hoover provided the basis for the Desert Range when he withdrew 87 square miles of land from the public domain as an "agricultural range experiment station," in February 1933. Grazing studies conducted by Intermountain Station researchers began the next year.

Most of the knowledge gained from past research is available—hundreds of scientific reports have been published. But how many ranchers and other range users have the time and resources to search this information for their particular needs? Probably not many.

To resolve this dilemma, the Intermountain Station recently began a program to summarize some of the most important research results in a series of reports. The reports will focus on (1) managing sagebrush-grass ranges, (2) managing salt-desert shrub ranges, (3) rehabilitating rangelands and wildlife habitats, (4) managing crested wheat-grass ranges, and (5) results of four decades of research conducted at Benmore.

Sagebrush-grass ranges

Practical answers to range managers' questions about sagebrush-grass ranges are now available in *Managing Intermountain Rangelands—Sagebrush-Grass Ranges*, General Technical Report INT-134-FR-36. Authors are James P. Blaisdell, a former Assistant Director of the Intermountain Station, now retired; Robert B. Murray, range scientist, Agricultural Research Service, U.S. Sheep Experiment Station, Dubois, Idaho; and E. Durant McArthur, project leader at the Intermountain Station's Shrub Sciences Laboratory, Provo, Utah.

Sagebrush-grass vegetation occupies a substantial part of the western range, extending over much of Utah, Nevada, southern Idaho, and eastern Oregon. Estimates of acreage vary from some 95 million acres to 270 million acres. Even if the lower estimate is accepted as reasonably accurate, sagebrush-grass vegetation is one of the largest range ecosystems in the western United States.

Because of their size, accessibility, and potential productivity, sagebrush-grass ranges are an important resource for production of livestock and wildlife, watershed values, and many recreational activities. Unfortunately, much of this valuable land was depleted during the early years of western settlement by abusive grazing, unregulated and recurrent fires, and cultivation and abandonment of marginal lands. According to Dr. Blaisdell, the sagebrush ecosystem is still far below its potential in livestock forage, wildlife habitat, and environmental quality.

Classification

Because recent research has shown that the ecology of sagebrush ecosystems is more varied and complex than once thought, Dr. Blaisdell and the others devote considerable space in their report to classification of those ecosystems by habitat type. The habitat type concept enables researchers and range managers to identify areas that have the greatest potential for productivity. The authors offer general management guides, modified as necessary, for certain types.

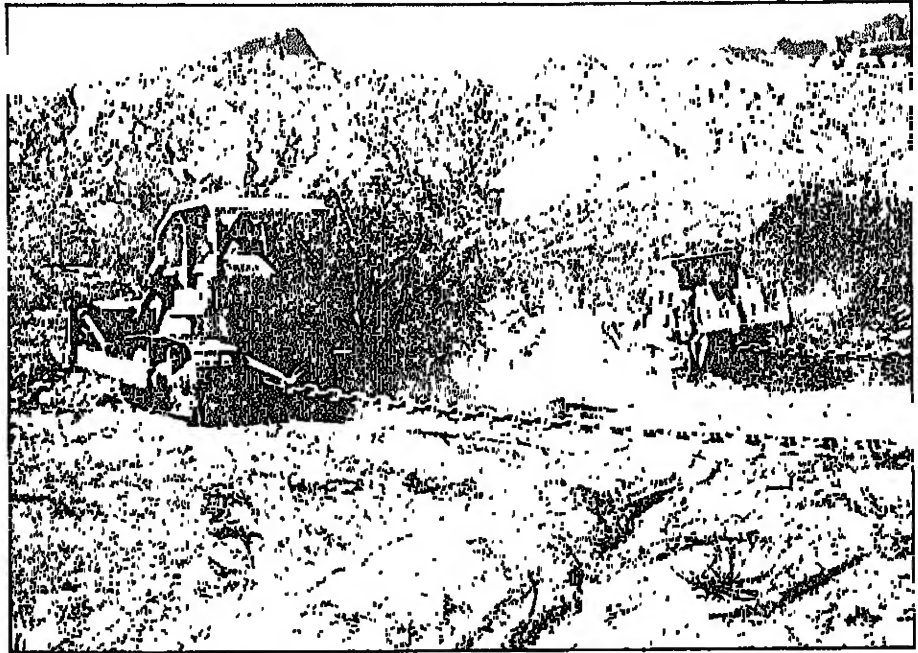
Condition and trend

Little information is available on condition and trend of sagebrush-grass ecosystems, but general guides for recognizing the two factors were developed by Intermountain Station scientists in southern Idaho over 25 years ago. Blaisdell says these can be broadly used by a manager to judge range condition and trend for different habitat types or sites, especially those at intermediate and low elevations.

According to the scientists, four conditions can be readily recognized: (1) Sagebrush with a good understory of perennial grasses and forbs; (2) sagebrush with a sparse understory of perennial grasses; (3) sagebrush with an understory of annual grasses and weeds; and (4) ranges with sagebrush replaced by cheatgrass or other annuals. For each of these four categories, the authors list indicators that managers should monitor over a series of years for definite confirmation.

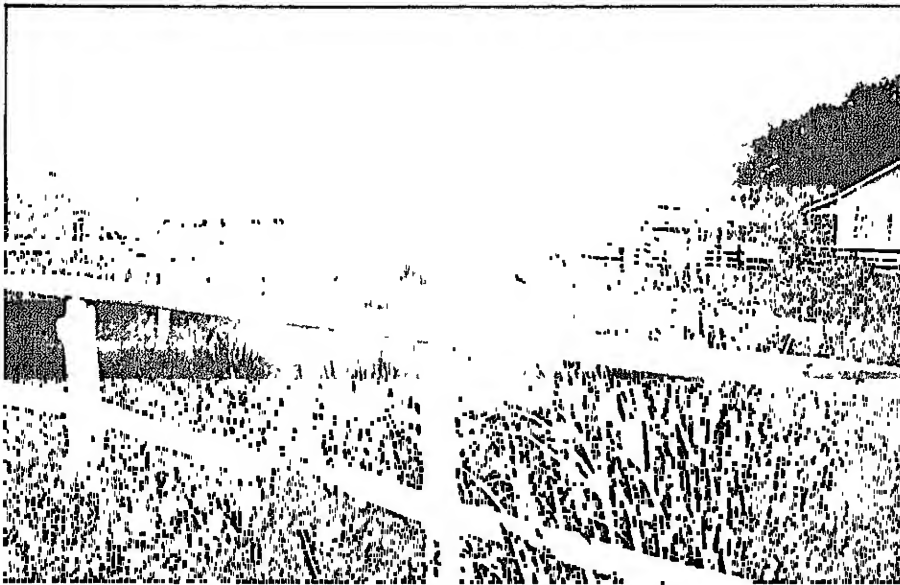
Managing the sagebrush-grass ecosystem

Management objectives for sagebrush-grass ranges may be described in a number of ways: wise multiple use, maintenance or improvement of vegetation and soil, or perhaps optimum sustained-yield of livestock and wildlife consistent with other uses and values. Dr. Blaisdell says that, although emphasis may vary with specific conditions or situations, it is logical to direct primary attention to conservation of the basic resources, soil and vegetation.



Although stable soil is always a prerequisite to satisfactory condition, vegetation is more easily observed and measured. Despite great diversity in the various habitat types of sagebrush-grass range, the situation today is too much sagebrush and other low-value shrubs, too many annuals, and not enough perennial grasses and forbs. Blaisdell says, "Simply, then, vegetation management often requires a reduction in sagebrush and an increase in perennial grasses and forbs."

Researchers use a well known brush clearing technique developed during studies over many years.



Open ranges combined with private land operations make a productive livestock unit.

How to accomplish that balance? The authors address this question in discussions of sagebrush control methods: burning and its ecological effects, spraying; mechanical removal; and biological control. They also present information on revegetation methods, grazing (intensity and season), and grazing systems.

Other uses and values

Although the primary use of sagebrush-grass range has been grazing by domestic livestock, more recognition has been given in recent years to its use as wildlife habitat, as watershed for the production of quality water, as wildland with many recreation opportunities, and as a resource available for supplying unforeseeable needs.

Dr. Blaisdell says, "Today, the once basic premise of maximum livestock production is tempered with a stewardship philosophy of conservation of the entire resource and protection from irrevocable damage. The decades of range studies help support that philosophy and ensure that the rangelands will meet the demands placed upon them in the future."

The completed report on sagebrush-grass ranges is an important step in the Intermountain Station's program to summarize the results of the wide spectrum of rangeland research. The other four reports, now in preparation, will be available in coming months.

Rangeland managers will be interested in another report available from the Station, *Improvement of Range and Wildlife Habitats in the Intermountain Region*, General Technical Report INT-157-FR-36. It contains reprints of 28 papers presented at workshops sponsored by the Station, the Northern Region of the Forest Service, and the Bureau of Land Management. The report includes discussions on principles of wildland restoration, manipulation of plant communities; species recommended for major plant communities; advances in plant selection and development; and management practices.

Clearcutting and natural regeneration... northern Sierra Nevada

Clearcutting in stands of young-mature mixed conifer and hardwood trees is being increasingly practiced in north-central California because the persistent hardwood understory beneath the conifer canopy adversely affects conifer regeneration and growth.

Although clearcutting is a relatively new method of silvicultural regeneration in the area, forest land managers have the benefit of calling on the results of 20 years of research, based on a series of experimental clearcuttings in the Challenge Experimental Forest in Yuba County, California.

Research foresters and silviculturists at the Pacific Southwest Station designed the experiments to test various approaches to clearcutting, combined with other treatments, such as site preparation and slash disposal by broadcast burning and windrow burning. The clearcutting was done on 41 compartments ranging in size from 7 to 60 acres. Natural seedfall was measured, and surveys of natural regeneration were begun in 1964 and carried on through 1982.

The results of these 20 years of experiments are now available in a Pacific Southwest Station publication. Write for *Clearcutting and Natural Regeneration. . . Management Implications for the Northern Sierra Nevada*, General Technical Report PSW-70.

All about red alder

Perhaps not all, but certainly most of what is known about red alder is summarized in a report available from the Pacific Northwest Station: *Red Alder: A Bibliography with Abstracts*, General Technical Report PNW-161, by Charles F. Heebner and Mary Jane Bergener. The bibliography lists 661 references to world literature about red alder (*Alnus rubra* Bong.). Included are publications on taxonomy, biology and silvics, chemical and physical information about its wood and fiber, studies on its nitrogen-fixing properties, and reports on industrial uses and economic considerations

The report is informative, even if you never get copies of the original documents. For example, summaries of two citations provide the following information:

- Large areas of pine forest in the Nuremberg Reichswald were killed by the pine looper in the 1890's. Because pine monoculture contributed to the severity of the damage, pine, spruce, and alder were mixed in the recent plantations. Both red and white alder grew vigorously and the alder created favorable conditions for the conifers, which promise to make a highly productive forest that is resistant to insect attack (10)

- Pollen diagrams from sediments in Lake Washington record changes in the vegetation around the lake since the mid-19th century. The primeval forest was primarily conifer. Some alder was present during the years of early settlement between 1860 and 1890. A much greater increase of alder followed the intensive logging operations of the 1880's, but in more recent years, creation of second-growth conifer forests on a large scale has again reduced the amount of alder pollen in the sediments.(132)

Measuring the success of revegetation efforts

If you're involved with evaluating the success of revegetating mined lands or interested in sampling techniques, a new publication issued by the Intermountain Station could be helpful

Methods for Vegetation Sampling and Analysis on Revegetated Mined Lands, General Technical Report INT-151-FR-36, provides a summary of the major sampling methods used to evaluate revegetation success. Cover, production, density, and species diversity, the most useful in such evaluations, are discussed as they relate to revegetation of pastures, grazing lands, and woodlands. The report also includes statistical methods for determining sample size and comparing two different areas. Problems of sampling are presented in terms of general vegetation types that personnel are likely to encounter.

The report, by Jeanne C. Chambers and Ray W. Brown, includes a discussion of laws and regulations governing successful mine revegetation.

The Intermountain Station has copies.

Growth classification systems for red fir and white fir

The Pacific Southwest Station has just issued a new General Technical Report . . . *Growth Classification Systems for Red Fir and White Fir in Northern California*, that should make significant contributions to the sound, long-term management of California's true firs.

Growth classes are defined on the basis of percent annual basal area increment (PCTBAI) into three classes. Predictor variables used are crown class, percentage of live crown, percentage of crown ragged or missing, and stem diameter at breast height.

Growth classification equations and the equation for calculating actual PCTBAI can be programmed into pocket calculators for field use, making the system faster and less laborious to apply than direct measurements of growth.

The systems will be helpful in marking stands for partial cutting intended to maintain acceptable growth in the residual stand, and for predicting stand growth and yield.

The test plots on which the systems were based were distributed from Lassen Peak, northern California, north to the Oregon border. Plots sampled included most stand types and site qualities within this range. Additional sites were sampled in the central Sierra Nevada to test the systems. The systems are considered applicable to all red fir and white fir 4 inches d.b.h. and larger in northern and central California.

Write the Pacific Southwest Station and ask for General Technical Report PSW-72.

Guide to identification and postfire management of five California oaks

Oak trees are found on at least 20 million acres in California in open woodlands, mixed with other species in the mountains, and in the chaparral lands. Although their current value as a timber resource is limited, oak trees play significant roles in stabilizing soil for watersheds, in providing wildlife habitat and mast (nuts), and for recreation and esthetic values.

Currently, there is a growing effort in southern California to use prescribed burning to reduce fuel buildup and fire hazard in chaparral and other wildlands where oaks are found. Because all oaks are subject to some damage by fire, with the extent and effects of that damage frequently varying by species, land managers need information to help them correctly identify species and evaluate their susceptibility to fire damage before they can select effective management plans for the oaks.

The Pacific Southwest Station has recently published a General Technical Report that provides guidelines for identifying five of the prominent species of southern California oaks—coast live oak, interior live oak, California black oak, canyon live oak, and California scrub oak.

The publication provides specific information for the identification of each of the five species; describes ways to assess fire damage for the trees on the basis of species, diameter, and degree of trunk or bark charring; and outlines postfire management alternatives for fire-damaged trees.

Write for: *Five Southern California Oaks: Identification and Postfire Management*, General Technical Report PSW-71.

Land classification system for eastern Idaho – western Wyoming

The forests of eastern Idaho and western Wyoming occupy an area of complex geology, varied climatic patterns, and merging plant groups. The result is a diverse mosaic confounded by periodic disturbance. Yet those who manage these lands must shape this diversity into manageable units. Classification of the lands by habitat type helps.

A land-classification system based upon potential natural vegetation of the forests of eastern Idaho-western Wyoming is available in a report issued by the Intermountain Station. Based on reconnaissance sampling of about 980 stands, the system is the result of a cooperative effort between the Station, the Forest Service's Intermountain Region, the Bridger-Teton National Forest, and the Shoshone National Forest. The Bureau of Indian Affairs provided funding for a concurrent study, the results of which are included in *Forest Habitat Types of Eastern Idaho-Western Wyoming*, General Technical Report INT-144-FR 36. Authors are Robert Steele, Stephen V. Cooper, David M. Ondov, David W. Roberts, and Robert D. Pfister.

The area covered by this classification extends from Monida Pass on Interstate 15 in Clark County, Idaho, southwest to the Utah and Nevada borders, and east through the adjacent forests of Wyoming. The authors define six climax series, 58 habitat types, and 24 additional phases of habitat types. They also provide a key for field identification of the types based on indicator species used in the development of the classification.

The classification is presented as follows:

1. Key to the habitat types.—The first step in correct identification of the habitat type is becoming familiar with use of the key. Next comes identification of the potential climax series, followed by identification of the habitat type and then the phase.
2. Series description.—Many habitat type characteristics are summarized at the series level, rather than repeating general similarities in vegetation and habitat characteristics for each habitat type description.
3. Habitat type description.—This information summarizes geographic range, vegetation, phases, and general management implications.

Copies are available from the Intermountain Station.

Modified utilization gauge

Accurate, low-cost measurements of forage utilization by livestock are essential in management of new grazing systems. However, because of difficulty in making these measurements, visual estimates are often substituted for measured values.

Scientists with the Rocky Mountain Station have now revised range utilization calculating charts into a pocket-sized utilization gauge which promises to replace visual estimates of range needs.

The gauge enables land managers to make accurate, low-cost measurements of forage utilization by livestock, based upon height-weight relationships for 43 grass and grass-like species in the Southwest.

The gauge is compact and is easily read after measuring the height of both grazed and ungrazed plants. Detailed instructions for field use are printed on the back of the gauge. The gauges are available from author-scientists Earl Aldon and Richard Francis, Rocky Mountain Station, 2205 Columbia S.E., Albuquerque, New Mexico, 87106.

Mistletoe control studies published

After 27 years, a study to determine the feasibility of controlling dwarf mistletoe in heavily infected mature stands of ponderosa pine has reached some satisfying conclusions. The study, on the Fort Valley Experimental Forest near Flagstaff, Arizona, involved a virgin stand of ponderosa pine in which 45 percent of all trees were infected with dwarf mistletoe.

Results from this study helped answer questions such as:

1. Can dwarf mistletoe in heavily infected mature stands be controlled through such silvicultural measures as harvest cutting and stand improvement?

2. What is the influence of light improvement selection cutting on dwarf mistletoe?

3. What are the relative costs and returns from practices that stress dwarf mistletoe control?

4. Is dwarf mistletoe control a sound management objective in heavily infected stands?

The three treatments tested were conducted on nine 25-acre plots and involved:

1. Light improvement selection (LIS).
2. Limited dwarf mistletoe control (LC).
3. Complete dwarf mistletoe control (CC).

The study concluded that the following measures are necessary in order to control dwarf mistletoe in heavily infected mature stands of ponderosa pine.

1. Eliminate the source of infection in the overstory by cutting all infected overstory trees;
2. Remove infection in pole and sapling stands by cutting or pruning;
3. Retreat the area periodically;
4. Regenerate the area if needed.

Copies of *Silvicultural Control of Dwarf Mistletoe in Southwestern Ponderosa Pine*, by L. J. Heidmann, can be obtained from the Rocky Mountain Station. Ask for Research Note RM-433.

Managing bitterbrush and cliffrose

Bitterbrush and cliffrose are important native shrubs on approximately 25 million acres in western North America. They are the mainstay of the diet of wintering mule deer throughout much of their range and provide vital watershed protection to otherwise unstable erosive land.

Over the past several decades, a great deal of research has been conducted in areas where these two shrubs occur. Land managers have intensified their efforts to explore the shrubs' use for wildlife, range livestock, and revegetation.

In 1982, the Intermountain Station and Utah State University, Logan, sponsored a symposium on bitterbrush and cliffrose. Held in Salt Lake City, the symposium drew some 120 participants who discussed and presented papers on research and management of the two shrubs.

The 27 papers presented at the symposium are reprinted in *Proceedings—Management of Bitterbrush and Cliffrose in Western North America*, General Technical Report INT-152-FR-36. Subjects include: (1) distribution, taxonomy, and habitat classification; (2) growth performance, phenology, and physiology; (3) successional relationships; (4) management strategies; (5) animal relationships; (6) soil-plant nutrient relationships; and (7) fire relationships.

Copies are available from the Intermountain Station.

Tussock moth how-to series completed

The how-to handbook series on the Douglas-fir tussock moth published under the 1974 USDA Combined Forest Pest Research and Development Program is essentially complete. All handbooks originally planned in the series have been published; most are still available from the Pacific Northwest Station. The complete series includes the following:

To order any of the publications listed in this issue of *Forestry Research West*, use the order cards below. All cards require postage. Please remember to use your Zip Code on the return address.

Please send the following Pacific Northwest Station publications:

- ☐ Red Alder: A Bibliography with Abstracts, General Technical Report PNW-161.
- ☐ Classification, Description, and Dynamics of Plant Communities After Fire in the Taiga of Interior Alaska, General Technical Report PNW-307.

☐ Please send the following in the Douglas-fir Tussock moth series:

Send to:

Please send the following Intermountain Station publications:

- ☐ Managing Intermountain Rangelands—Sagebrush-Grass Ranges, General Technical Report INT-134-FR36
- ☐ Improvement of Range and Wildlife Habitats in the Intermountain Region, General Technical Report INT-157-FR36.
- ☐ Forest Habitat Types of Eastern Idaho-Western Wyoming, General Technical Report INT-144-FR36.
- ☐ Proceedings—Management of Bitterbrush and Cliffrose in Western North America, General Technical Report INT-152-FR36
- ☐ Methods for Vegetation Sampling and Analysis on Revegetated Mined Lands, General Technical Report INT-151-FR36.

Send to:

Please send the following Rocky Mountain Station publications

- ☐ The Santa Rita Grazing System, from *Proceedings of the First International Rangeland Congress*, 1978
- ☐ Responses of Semidesert Grasses and Shrubs to Fall Burning, a reprint
- ☐ Silvicultural Control of Dwarf Mistletoe in Southwestern Ponderosa Pine, Research Note RM-433

Send to:

Please send the following Pacific Southwest Station publications

- ☐ Clearcutting and Natural Regeneration Management Implications for the Northern Sierra Nevada, General Technical Report PSW-70.
- ☐ Growth Classification Systems for Red Fir and White Fir in Northern California, General Technical Report PSW-72
- ☐ Five Southern California Oaks Identification and Postfire Management, General Technical Report PSW-71

Send to:

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Intermountain Forest and Range Experiment Station
507 25th Street
Odgen, Utah 84401

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AH 517, *How to Identify Tussock Moths Caught in Pheromone Traps*, by G. E. Daterman, R. L. Livingston, and R. G. Robbins (out of print).

AH 520, *Rearing the Douglas-fir Tussock Moth*, by Clarence G. Thompson and Linda J. Peterson. (limited copies available)

AH 532, *How to Time the Sampling of Tussock Moth Larvae*, by B. E. Wickman.

AH 536, *Larval Instars of the Douglas-fir Tussock Moth*, by R. C. Beckwith.

AH 543, *You Could Spot the Next Tussock Moth Outbreak! Here's How*, by Jerald E. Dewey.

AG 545, *How to Construct Larval Sampling Equipment*, by H. Gene Paul.

AH 546, *How to Use Pheromone Traps to Determine Outbreak Potential*, by G. E. Daterman, R. L. Livingston, J. M. Wenz, and L. L. Sower. (limited copies available)

AH 547, *How to Sample Douglas-fir Tussock Moth Larvae*, by Richard R. Mason.

AH 548, *How to Determine the Occurrence of Virus in Egg Masses*, by M. J. Stelzer.

AH 549, *Predation and Parasitization of Douglas-fir Tussock Moth Egg Masses*, by Torolf R. Torgersen and Richard R. Mason.

AH 550, *How to Estimate Defoliation and Predict Tree Damage*, by B. E. Wickman.

AH 568, *The Douglas-fir Tussock Moth Management System*, by Robert W. Campbell and Ronald W. Stark

AH 569, *Rating the Risk of Tussock Moth Defoliation Using Aerial Photographs*, by Robert C. Heller and Steven A. Sader.

AH 599, *How to Determine the Number of Douglas-Fir Tussock Moth Eggs From Egg Mass Weight*, by R. C. Beckwith, R. R. Mason and H. G. Paul.

AH 602, *Techniques for Monitoring the Effects of Insecticides on Forest Fauna*, by Patrick J. Shea, Richard C. Reardon, and Stamford D. Smith

AH 604, *Protecting Ornamental and Shade Trees*, by J. P. Linnane and M. J. Stelzer.

AH 610, *How to Predict Population Trends*, by Richard R. Mason and T. R. Torgersen.

Handbook 517 is out of print and no longer available. Handbooks 602 and 604 are also out of print, but copies can be obtained from the National Technical Information Services (Access: PB83 159830, paper copy (A03) \$8.50, microfiche (A01) \$4.50). Write to

NTIS
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161.

Plant communities following fire in interior Alaska

Readers in Interior Alaska, and others responsible for managing natural resources in the northern taiga forest ecosystems, will certainly want to have their own copy of a new paper from the Pacific Northwest Station. It's *Classification, Description, and Dynamics of Plant Communities After Fire in the Taiga of Interior Alaska*, General Technical Report PNW-307, by Joan M. Foote.

Foote has done a monumental work in describing and classifying the plant communities in interior Alaska. One hundred thirty forest stands were sampled ranging in age from 1 month post-fire to 200 years. They are described by successional series (white spruce and black spruce) and by developmental stage (newly burned, moss-herb, tall shrub-sapling, dense tree, hardwood, and spruce). Patterns of change in the two successional series are described as 12 mature forest communities.

This paper reports the first phase of research that was started in the area of the Wickersham fire (1971) near Fairbanks and then expanded to other areas of the interior, primarily along the roads south of the Yukon River. The work was funded by the U.S. Department of the Interior, Bureau of Land Management, the National Science Foundation, and the USDA Forest Service. Phases 2 and 3 of the work will increase both the number of community types and the number of replications studied.